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*The Saratoga Spittlebug*Harvey J. MacAloney and Louis F. Wilson¹

The Saratoga spittlebug (*Aphrophora saratogensis* (Fitch)), so called because it was first collected in Saratoga County, N.Y., is a native insect and was described over 100 years ago. It has been reported coast to coast—in southern Canada and the northern United States, south into the east Central States and Florida, and also in California. It has been a major pest of red pine and jack pine plantations in Michigan and northern Wisconsin since 1941, when many young plantations were so severely damaged as to be considered failures. Since chemical suppression was begun in 1946, more than 100,000 acres of plantations of all ownerships in Michigan and Wisconsin have been sprayed.

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Hosts **PROCUREMENT SECTION**
CURRENT SERIAL RECORDS

Red pine is the preferred host of the adult spittlebug. Jack pine follows, although decreased planting of this species in recent years has lessened its importance as a host. White pine is frequently fed upon but seldom damaged severely. Adults thought to be *Aphrophora saratogensis* have been collected from branches of pitch pine, tamarack, balsam fir, and northern white-cedar—usually from trees near infested red pine.

The nymphs require alternate hosts for their development. The early instars are commonly found on herbaceous species such as orange hawkweed, everlasting, aster, and ragwort, whereas, the later instars prefer woody plants such as sweetfern, brambles, prairie willow, and aspen sprouts.

Damage

Damage is usually limited to trees between 2 and 15 feet tall, although larger trees are attacked. Signs of injury are: (1) reddish-brown "flags" in part or all of the crown in the spring (2) nu-

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merous tiny punctures on the twigs (fig. 1), most abundant on the 1-year-old growth (the 2-year-old internodes) and often covered with droplets of resin; and (3) light tan or brownish flecks on the surface of the wood and the inner bark where the punctures occur—visible when the bark is removed.

Severely injured twigs have dead areas that are sometimes dark and usually infiltrated with resin. These are symptoms of the feeding activities of the adults and, in the early years of the infestation on jack pine, of the presence of the burnblight fungus (*Chilonectria cucurbitula* (Curr.) Sacc.), which enters through the feeding punctures and hastens twig mortality. On red pine the fungus is only weakly pathogenic, and the burn-blight condition apparently does not develop in sprayed plantations. The affected parts are killed by sap withdrawal by the insect and blocking of the conducting tissue caused by resin infiltration around the punctures. The foliage usually drops from the attacked branches within a year and a half.

Description

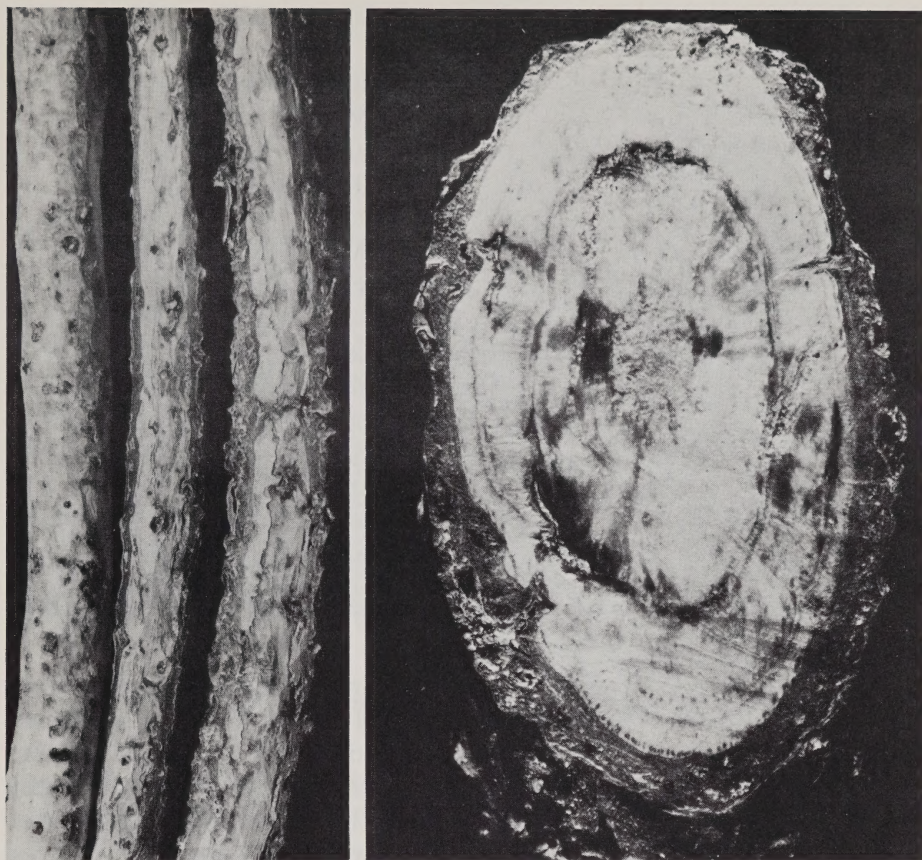
The adult is winged and about 1 centimeter long (fig. 2); the female is slightly larger than the male and distinguished by its swordlike ovipositor. The base color is brown with tan to silvery-white markings—like a red pine twig. The egg, about 2 millimeters long, is shaped like an elongated teardrop, and is glistening yellow

to purple. The nymphs range from 2 millimeters when hatched to 8 millimeters just before transformation to the adult stage. The most striking characteristic in the first four stages is the scarlet abdomen, bordered by black at the sides and contrasting sharply with the jet black head and thorax. In its fifth or last stage the nymph is uniformly dark brown.

Life History and Habits

There is one generation annually, and the insect overwinters in the egg stage. On red pine the eggs are laid under the outer scales of buds in the upper branches (fig. 3). Usually several are laid in each bud, causing a noticeable irregularity on the outer surface of the bud scales. On jack pine the eggs are laid in the needle sheaths; apparently the buds are too hard and resinous for this use.

In the Lake States, hatching is usually completed by mid-May, and the young nymphs drop or are blown to the ground, crawl to their host plants, and begin to feed, usually in groups. As they feed, they form the characteristic spittlemass which prevents their desiccation (fig. 4). The young nymphs feed on several herbaceous plant species and in their fourth and fifth stages many migrate to sweetfern and brambles (raspberry and blackberry). There is evidence that severe damage will seldom occur in a plantation unless (1) at least one of these early host species is present, (2) plant density averages at least



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Figure 1.—Saratoga spittlebug damage: *Left*, Scars from adult feeding-punctures on pine twigs; *right*, cross section of a pine twig showing scar tissue in early growth layers.

one per square foot, and (3) the late-instar nymphs average one or more per plant. When they have finished feeding, the fully grown nymphs leave the spittle-masses, climb to the upper parts of their host plants, and transform to the adult stage. Depending on weather conditions, the nymphal period varies from 40 to 70 days.

The adults fly to the pine hosts and feed on the needle-bearing twigs. They are strong fliers and, when disturbed, dart from the

twigs at such speed that the direction of flight may not be noticed. They are active from late June to the end of September, but peak activity is from mid-July to mid-August, when approximately 90 percent of the feeding damage occurs. Mating occurs soon after transformation, and the peak of egg laying is reached within 3 weeks.

Natural Control

Adverse weather occasionally kills spittlebugs. The nymphs are



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Figure 2.—Adult Saratoga spittlebug

particularly susceptible to desiccation during dry hot weather, especially in open stands where ground cover is lacking. During late spring, short periods of air temperatures in the low 20's (°F.) and longer periods of 30° F. are highly destructive to exposed nymphs. Nymphs feeding on plants covered by forest litter are usually well protected.

Several biological agents reduce spittlebug populations, but none has ever been considered effective in control. Eggs are attacked by two tiny wasps, *Ooetonus aphrophorae* Milliron and *Tumidiscapus cercopiphagus* Milliron, but known parasitization has not exceeded 5 percent. Flies have

caused up to 50-percent parasitization of the adult spittlebugs, and adults and nymphs are occasionally preyed upon by ants, spiders, and birds. No parasites of the nymphs are known.

Cultural Control

Spittlebugs do not cause economic damage without alternate hosts and seldom become abundant unless the preferred alternate hosts—sweetfern or raspberry plants—are plentiful. Eradication of these perennials in established stands has not proved successful. Herbicides tested in sufficient quantities to kill the alternate hosts have also injured the pines.

Alternate hosts should be considered when planting sites are selected. Pines should be planted on sites best suited for them and where the other hosts are absent. Otherwise, trees should be planted the minimum acceptable distance apart so that the ground vegetation will be shaded out early.

Chemical Control

Aerial and ground applications of malathion may be used to suppress the spittlebug. Malathion is recommended because it is an effective but nonpersistent chemical of low toxicity to humans and warm-blooded animals.

Large plantations and naturally occurring stands of infested trees should be treated by aircraft. Recommended dosage consists of undiluted 95-percent Malathion LV concentrate applied at the rate of 8 to 10 fluid ounces



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Figure 3.—Eggs inserted between scales of red pine bud.

per acre. A solvent is not necessary if the aircraft is equipped



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Figure 4.—Spittlemass formed by nymphs at base of sweetfern.

with special low-volume spray nozzles. When special nozzles are not available, suppression is equally effective with 95-percent Malathion LV concentrate in a suitable solvent (Panasol AN-5 or equivalent). No. 2 fuel oil may be substituted, but it is less satisfactory and more volatile than commercial solvents. The recommended mixture contains 1 gallon of malathion in each 9.5 gallons of solvent, to be applied at the rate of 1 gallon per acre.

Small plantations can be sprayed with a backpack mist-blower. An undiluted formulation of 95-percent Malathion LV concentrate should be applied at the rate of 6 fluid ounces per acre. Another effective mixture is one-half pint of the same concentrate in 1 gal-

lon of solvent (Panasol AN-5 or equivalent). The latter solution is applied at the rate of 1 gallon per acre. Both sprays should be applied when 80 percent of the insects are in the adult stage. The mist should be aimed over the trees to prevent the solvent from burning the foliage.

The spraying period varies yearly and at different locations but is usually between the first and third weeks in July. Spray date can be projected from nymphal development; it usually should be 15 days after the peak of the fifth (last) nymphal stage. Development should be watched closely, however, because adult transformation may be retarded by cool rainy weather.

CAUTION: Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Department of Agriculture, consult your county agricultural agent or State Extension specialist to be sure the intended use is still registered.

References

- SARATOGA SPITTLBUG INJURY TO PINE. ROGER F. ANDERSON. J. Econ. Entomol. 40(1):26-33. 1947.
- THE SARATOGA SPITTLBUG. ROGER F. ANDERSON. J. Econ. Entomol. 40(5): 695-701. 1947.
- THE SARATOGA SPITTLBUG; A DESTRUCTIVE PEST IN RED PINE PLANTATIONS. HERBERT G. EWAN. U.S. Dep. Agr. Tech. Bull. 1250, 52 pp., illus. 1961.



Use Pesticides Safely
FOLLOW THE LABEL

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